SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Royal School of Mines, Jermyn-Street.

Mr. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR REPORTER.]

Lecture XXXIV. (*Continued.*)—Other methods of securing shafts must be sought when they could not get a foundation on which to build up the tubbing. He knew of cases in which a great number of engines had been brought together of the largest calibre, perhaps 700 or 800 horse power; and yet, after spending thousands of pounds, they had failed by pumps to keep the water under; and inasmuch as in the future course of mining it would be necessary to sink deeper and deeper shafts, the safety of such works, and their economical prosecution, were points of the highest importance. A system had been tried for some years, in very loose and dangerous ground, of sinking the tubbing *en masse*, as it were. The shaft being sunk of considerably larger dimensions than those ultimately to be attained, the upper portion would be opened by means of frames and spilling laths. When the difficult ground was arrived at, the walling would be built upon wooden curves, shod with iron, so as to cut into the ground, and then as the weight increased the whole mass would begin to sink, with perfect evenness. It was in this way the great shaft at the Thames Tunnel was sunk, a work that reflected the highest credit upon the skill and ingenuity of the elder Brunel. In the same way, this plan was used to secure large shafts; and as an instance he would refer to the Clifton Colliery, in Derbyshire, where the sinking was in the valley of the Derwent, and full of water, and where, therefore, the tubbing was sunk entire, instead of in segments. A most remarkable example of this kind of sinking was the works at the piers of Blackfriars Bridge, the framework there being 18 ft. in diameter; and as each section of the frame was got into place, another was placed upon it, till the weight became considerable, each section weighing 27 tons, lowered by very powerful machinery, until it was pressed down below the sand and gravel of the river bed, until it became well fixed on the solid London clay. The water was thus tubbed out to a depth of 65 ft., and the men could then build up the piers within as they pleased. Some excellent works of this sort existed on the Loire, executed by the well-known geologist and mining engineer, M. Triger, who invented a very ingenious mode of dealing with cases of this kind. He noticed that the ordinary pressure of water being 15 lbs. to the square inch, an equal pressure of air kept it back, and, therefore, contrived an apparatus by which the air in the shaft was compressed to the same density. The difficulty was to get the workmen in and out of the condensed air without losing the pressure, but this was overcome by means of an intermediate chamber, in which the air was managed like the water in a canal lock. The work was done in the lower chamber, and the men having ascended into the intermediate chamber above, the communication was closed, and then they could go forth into the natural atmosphere.

Mr. Smyth then described a number of other instances where sinkings were effected in watery sands and other difficult ground, mentioning particularly those of Ruhrait, on the Rhine, at the extremity of the Westphalian coal measures; those of the St. Avold Mining Company, in the eastern part of France, where M. Kind had sunk those bore-holes of large size to which he had already alluded; and the plans of M. Guibal, a Belgian engineer of celebrity.

Lecture XXXV.—They might now pass from the subject of shafts and levels, and supposing them to be properly sunk, driven, and secured, they must next consider the means by which the mineral had to be worked away—the "exploitation," as it was called by the French, of the contents of a mine. Here, again, it was necessary to remember that the circumstances under which the useful minerals occurred were extremely various, according to the inclination, thickness, hardness, depth, and character of the ground to be operated upon. These conditions might also vary according to whether or not the entire body of the mineral was worked away. Take the example of two very opposite cases—a bed of good coal and a band of ironstone. In the former the whole would have to be taken away, and would find purchasers; while in the latter a large portion being waste would, if possible, have to be left behind. And so in the case of a lode. Very often veins were met with which contained the metal sought for—as, for instance, tin—disseminated through the entire mass, and, consequently, all had to be removed; but in the case of copper a large portion had to be left behind. Although the conditions offered so much variety for consideration in all the arrangements needed for the purpose of working out the mineral, there were certain necessary conditions to be kept in view, viz.:—

1. It was very important to keep the ground in work well drained, so that the men working on the ore shall be clear of water. There were dozens of cases where for lack of care in this respect the men were obliged to work in water, and the mineral was thus raised prematurely.

2. The works should be disposed in such a manner, with respect to the shafts and levels, as to make the carriage or transport of the ore economical.

3. The ventilation of the working places must be carried forward as perfectly as possible, both with a view to the saving of time, to economy, and to prevent danger to the health and lives of the workmen. For instance, if they took the case of a level 150 fms. from the surface, driven very much in advance of the other levels, which was often the case, the ventilation would be found extremely difficult to deal with, so as to enable the men to work satisfactorily, and without injury to health. The natural remedy in such a case was to sink a winze or shaft to the nearest workings, or to mitigate the evil by procuring the use of a ventilating machine.

4. Preparatory or exploratory levels, both on the strike and on the dip, should be carried on while the other portions were being worked out. Where this was fairly done, great lengths might be opened up in poor ground, without being so serous a charge as they would be if not counterbalanced by profitable works in other parts. In a small mine of two shafts, if the manager had not a proper degree of prudence and forethought, they would constantly find a great tendency to remove the ore, and to neglect the duty and avoid the expense of sinking other shafts and driving other levels. As soon as this neglect set in the closing of the mine began. In some cases it required much courage, as well as foresight, for it frequently happened that the manager would be sinking these shafts and driving these levels for years beforehand, until, perhaps, the good ground was nearly exhausted. If he did not do so, however, he would be compelled to fall back on the company, or adventurers, to get fresh capital, and if all the ends were poor at once no one would be induced to go on with such a mine. On the other hand, if exploratory levels had been already driven it not uncommonly occurred that a fresh course of ore would have been discovered, in any case a more favourable appearance, with which the owners would gladly go on till something better was met with, and this often occurred. When they heard of this tut or dead work not being pushed at times when the mine was doing tolerably well, they might be sure the owners were (though, perhaps, unwittingly) destroying their mine. Experienced captains of mines were perfectly aware when they were doing right in this respect, but it often happened that mines were abandoned because their hands were tied, and they were compelled by the owners to work them in a particular way. These mines when resumed by others would pay very well. If these mines were worked with a due regard for the future at first, a considerable amount of money would be saved, usually spent each time the mines were resumed. This fact should always be kept in view.

5. The working places should be so disposed that the largest possible number of men can be brought to bear on them at once, without inconvenience. This was a point sometimes very hard to manage in metalliferons mines. If the mines happened to be poor, and in one part of the vein good ore was met with, the managers were too apt to crowd men into that part, to get all they could from it; but even if it were for ventilation only, it was a bad policy to crowd a limited portion of the works, as the workmen interfered with and hindered each other.

6. Strenuous endeavours should be made to extract all the useful mineral without waste. This was best done in metalliferous mines by setting the ground on the system of "tribute," in which it was to the interest of the men to prevent anything like waste, and to examine the ground in every direction with care, so as not to allow any of the ore to get amongst the rubbish. In certain mines, however, it was absolutely necessary to leave valuable mineral behind, as well for the safety of the men as of the mine. In the Levant Mine a case in point occurred a year or two ago, At a comparatively shallow level, far out under the sea, a great outcry was raised by the men that the water was coming in, to their great danger, and threatening the destruction of the workings. The captains had to look closely into the matter to find out the real state of the case, and proved beyond a doubt that there was a considerable quantity of salt water going into the mine, but as this was an old and known "feeder," there was no reason to entertain fears for their immediate safety. The tin ore being in that part very good, but surrounded with hard and difficult rock, the miners had been allowed to work upwards towards where there might be risk. There was always a risk in cases of this kind, where a vertical fissure occurred, and where by taking away the ground the crust between the miners and the sea became more or less weakened. In this case it was determined not to go further. The managers put in strong timbering, to prevent any further settlement, and ceased to work in that particular spot. The same rule was applicable where the lode was inclined at a considerable angle, and where it was very difficult to replace its excavated substance by pillars. Although the lode might consist of good masses of ore, it might still be advisable to make some sacrifice, by leaving arches of the unworked lode, rather than run the risk of the roof coming in. In stratified deposits, where there was a bad roof, it might seem wasteful to leave 2, 1½, or 1 ft. of good coal as roof, but the reason for doing it was that, balancing the expense of supporting that portion of the roof against the loss of coal by leaving it to remain in the pit, the latter was the most advantageous.

7. Regard must be given to the settlement of ground at the surface, which might damage or destroy buildings, produce large hollows, or let in the waters of canals, rivers, or seas, and so occasion vast expense for repairs and compensation, which might frequently be avoided or lessened by early remedial action.

In considering the working of mineral veins, Mr. Smyth took for his illustration a large map of the Carn Brea Mines. It would be seen that there no levels were driven very near the surface, and for this reason—the lead and copper veins were known to be poor and unproductive until a certain depth was reached, and it would only be throwing away capital to drive levels at too shallow a depth. In Cornwall it was usual to drive levels every 10 fms., as it was found that by cross-cuts up and down the lode was well and sufficiently explored and tested, and no good piece of orey ground could well be overlooked, There were districts in which 15 fms. was the rule, but there were reasons for that course in the circumstances of the case. Having the levels opened out, the next thing was to remove the minerals, and the mode of doing this depended upon the distribution of the ore. If all the mineral were to be removed, a system of stoping was adopted, either what was called overhand or underhand. The former might be adopted in cases where the ground is suitable, but the latter was a much better plan, except in dealing with the precious metals and very valuable ores.

Lecture XXXVI.—In working veins of moderate size, with a pretty strong ground, there were no special difficulties; but when the ground was weak, and the lode so large that they were unable to keep open its whole breadth, the task was more formidable. Many different modes of working were in use, varying according to circumstances. A very common case was that in which it was necessary to use timbering, either in the lode itself or on its walls, to keep open the workings. A large lode was seldom a rich one throughout, or uniform, and it was, therefore, advisable for many obvious reasons to leave the attle behind. At the Ballieswidden Tin Mine, in West Cornwall, the vein varied from 6 ft. to 18 ft. in breadth. In some places there were parallel branches of rich crystalline tin ore, sometimes only a few inches thick; and in other parts the material, although not so rich, was strongly impregnated with the mineral, and therefore valuable, while the remainder was of no value at all. It was worked by overhand stoping, the miners piling the attle up behind them very carefully to surport the two walls, and this had to be done very perfectly, in order to avert the risk they would otherwise run; the greatest care, in fact, was requisite in working out these great masses, or otherwise a catastrophe would occur, and the whole workings be involved in one common ruin. Sometimes the weakness of the lode, which constituted a source of some danger, was turned to advantage, and there were cases in Saxony and Bohemia, and even in Cornwall, where the material wanted to be stamped for tin was let down with a run, and worked in this way for a long time without accident. It was dangerous, but with extreme care serious accidents were avoided. At the Polberro Mine, in Cornwall, it often happened that a quantity of fresh material, fathoms in extent, would be brought down by the crush. In the Isle of Man, at the Beckwith Mine, there was another remarkable working of a wide lode, which at a 90 fm. level was found to be 40 ft. in breadth. In this case a level was run on each side of the lode, and then cross-cuttings made; these cross-cuttings were then filled in with stone (of which there was, very fortunately, a good supply on the spot), and then the intermediate pillars were won. In some of these kinds of instances it was found necessary to open new shafts, for the purpose of filling such material from the surface, and it was sometimes worth while to quarry stone for this purpose.

As instances of this sort, the mines of Knockmahon and Rathstormer might be quoted, where several shafts had been sunk for the purpose of throwing down attle. In the same way the hematite deposits of Whitehaven, which were large, soft, and wide, afforded good examples of working such minerals. The shafts were sunk on the side of the lode, and the miners then drove out across. In Hungary, where the veins were 8 or 9 ft. in width, they always, if they could, begun the works near the bottom of the hill. They then cut away the ground *en masse* for some distance, and in making the levels the attle was carefully packed at the sides, like dry stone walling. Cross-cuts were then made, and packed with timber roofing laid in horizontally, and where there was not enough of attle, stone was sent down from the surface. The working by this crossing arrangement was capable of being carried out with a great amount of regularity, but in these deposits there often occurred great fragments of greenstone, isolated lumps of limestone, or masses of loose mud or clay, and then the plans must be varied to meet these difficulties. No regular rules, therefore, could be laid down with reference to wide and irregular deposits, or as to what ought to be done, but always remembering the general rules of economy, labour, and means, which should always be applied, the best plan would be suggested by the peculiarities of each case. Thus, at St. Austell an irregular mass of ore below the coal, from 4 to 6 ft. in breadth, was worked precisely like a lode—by overhand stopes; but if it opened out, as it might do, to 40 or 50 ft. in breadth it must be worked in some other way. As an instance of adopting peculiar methods to particular cases, he might mention the china-clay of Schneeberg, in Saxony. The beds lay in a semi-circular form, and were worked by shafts and levels driven round the extremity of the deposits, resulting in a series of workings, sometimes approximating to those used in lodes, and at other times to those of stratified beds.

Lecture XXXVII.—Mr. Smyth next proceeded to consider the means by which the intermediate portions of the ground had to be worked away in deposits of a stratified character, which were not horizontal, but lay at every variety of angle, as, for instance, in Belgium, where the angle of inclination was so great as to give them the appearance of mineral veins. In these cases the methods of working was so extremely various that he would confine his present remarks to beds which were only 20° or 30° out of the horizontal line. It was extremely important that a manager should be thoroughly aware of the various modes of laying out coal and ironstone mines practised in different districts. It was too often the case that because certain systems had crept into general use in any given district it was assumed that the working must always keep to that system, but a manager would often find that the systems of other districts might be advantageously introduced to meet special difficulties. It was also of the greatest importance that the manager in commencing a mine on the stratified deposits should form a definite plan as to what was to be done in the way of levels and carriage ways at the outset. On this would sometimes depend the economy of the whole arrangement, and the possibility, or otherwise, of securing a large "get," or yield, of mineral. It did not follow, however, that when the plan was made to embrace the whole area to be worked the actual working should commence in that extensive manner. It was better to arrange so as to deal with the deposit in sections, as the two great enemies, "thrust" and "creep," were liable to come on, interfering greatly with the workings, and perhaps rendering a whole section of the mine inaccessible. If he represented a portion of a series of workings by certain openings crossed by other openings, it would be obvious that, although sufficient might be left to support the roof for the time being, the pressure of the weight overhead would soon make itself felt, and that in various ways. If the floor were weak the weight of the pillars would make the floor to rise, or the thrust might push down the roof so much as to break the timbers by which it would be supported, and perhaps the level might be destroyed from either cause for a time. It thus became necessary to keep men constantly employed in the roadways and openings. Then, the crush sometimes was of a character to produce a great quantity of slack or small coal, which was of very little value. There were plenty of cases in the North of England where (before pillar working was so well understood as now) entire mines had been destroyed by crush and creep. As he had stated in a former lecture, the manager would begin by opening out workings on both sides of the shaft, and it had been too frequently the case in Yorkshire, where serious calamities and explosions had been the result, that a considerable quantity of coal had been at once got near the chief thoroughfares of the mine, creating goafs and gobs, which soon became dangerous from accumulations of fire-damp. This, he need hardly say, was to be greatly deprecated. In dealing, however, with deposits of a stratified character the thickness of the seam, its dip, and its depth from the surface were always to be taken into account, and in some methods of working it happened that for want of due attention to these points not more than half of the useful mineral was raised to the surface, and that, too, in cases where 95 per cent. at least might be extracted. There must, however, in all mines be refuse of some kind or other. Even in the case of certain very pure varieties of coal a great quantity of small or slack coal was produced and left behind as rubbish, while in other instances, as in what was frequently called dirty coal, with many partings, and in ironstone deposits, a large quantity of material had to be left behind, so much so as to fill up in great part the workings as they advanced. In coal mines, therefore, the great object was to raise as much round or large coal as possible, and the modes of undercutting and shearing should be adapted to the nature of the seam operated upon. In many cases, where the pillars were not of sufficient magnitude, what was left was almost literally crushed into slack. The question of pressure also came into play when the seams lay in proximity to each other. Supposing they had three seams one above the other, it was a question which could not be decided by any *a priori* reasoning which seam ought to be worked first, or whether one, two, or all three should be worked at once. For instance, the two seams nearest the surface might be coal of good quality, but not of that character which was in demand in the district at the time of the colliery; hence it might be imperatively necessary that they should work the lowest seam first; but, on the other hand, supposing the latter to be a fine thick seam of coal, and they extracted the whole of it, and the two upper seams were thin, and of inferior quality, it was a question whether the working of the two latter by themselves would prove sufficiently remunerative, and if not it would obviously have been wiser to have worked the whole of the seams at once. Another consideration was whether the working of one seam would affect the working of another—that was to say, whether it would take away the solid material upon which the other rested. Probably the removal of one of the lower beds would cause a subsidence of the others, in which event it became a question whether the subsidence would be of so serious a nature as to reduce the unworked seams into small coal, and whether it would only have the effect of rendering it easier for working. Another question was whether, having a certain piece of ground, they should begin to work the coal at once, or go to the far end of the limits before beginning to work on a large scale. The system of working out as they went on was coupled with the danger of putting goafs too near the shaft, which in case of an explosion in the goaf would thereby be endangered. On the other hand, it was more than any reasonable capital would allow to provide machinery and plant to carry out all the works before some return or output was obtained, unless the area was very moderate indeed as to extent. As a system regarded *per se*, there was much to be said in favour of working from the extremity and leaving all the exhausted places behind, giving no anxiety as to products or accumulations of gases. It was, no doubt, a clear perception of these advantages which suggested the elementary notions of pillar working, and the principle was to be found in the stone quarries of ancient Egypt, in the earliest coal workings in Turkey, in the oldest workings in this country, and in Ireland.

Lecture XXXVIII.—Mr. Smyth said that, having spoken somewhat fully upon subjects connected with the openings for working out the minerals in stratified deposits, he now came to consider what might be called the established systems of working, somewhat in detail. First, he would pass under review the system of working by openings crossed with other openings, leaving at the intersections pillars of greater or less magnitude. This system was that commonly called post and stall, or bord and pillar, or stall and pillar. It took its rise in the North of England, and its principal seat remained in those districts, although it was to be found elsewhere, modified in different ways. There were, in fact, so many varieties of the system that he should not attempt any general descriptions, but rather proceed to explain its principle and illustrate its varieties by examples. The first step was to drive out a pair of levels from the bottom of the shaft, it might be on three or four sides, but most commonly where there was a well pronounced dip in two directions, on the rise and on the dip. From these levels, of which there were always a pair, and sometimes a third at a greater distance from the second than the second from the first, bords were run in the whole coal. These working places, or stalls or bords, were in earlier days driven across the grain or cleat of the coal, and made as wide as possible, leaving the pillars so thin as to serve only for immediate security; and towards the outcrop of the Durham coal fields extensive areas were worked with the bords from three to five yards wide, and the pillars between one to three. As the bords advanced it was necessary to make cross drifts for ventilation, and headways about two yards wide, and sometimes three or four; if the roof happened to good, they would be carried "on the ends," at 28 or 30 yards asunder. If, however, it was necessary to keep these headways open as a means of communication, they were secured by timbers. The bords themselves were large open spaces, having narrow entrances, and it was, therefore, obvious that these thin pillars would soon become so much crushed as to be valueless. The result of this kind of working was that when there had been a tendency to "creep," arising from the weakness of (say) the clay floor, there had been a kind of run, and hundreds of acres of coal had been swallowed up. The downward pressure of the small pillars forced the clay to rise in the bords, choking the road and airways; the pillars then cracked, and the mischief spread from bord to bord, breaking down the roofs, and filling the workings with rubbish. The principle, therefore, then acted upon was to get as much coal as possible before these catastrophes occurred; but it was notably the case that not more than 40 per cent. was obtained in those days. At length the more enlightened coal viewers and engineers, and he might particularly mention Mr. Buddle and Mr. Nicholas Wood, thought that it might be better to drive so as to have less crush and creep. A considerable difference began to take place about 1795, and the pillars assumed larger dimensions. In some very deep mines they were now left 24 yards by 18 in size, and in that of Monkwearmouth they were 40 by 30 yards, and cases of crush and creep became very rare.

Some very curious points had been suggested as to the advisability, or otherwise, of commencing to work the deeper seams before the shallow ones, and several collieries in the Durham coal field, which had been worked to great depths, seemed to offer facilities for arriving at conclusions on the subject. At the Monkwearmouth Colliery, the Maudlin seam was met with at a distance of 265 fms. from the surface, and the Hutton seam at 285 fms., leaving a 20-fms. space between them, and both seams were worked contemporaneously. The Maudlin seam was no less than 6 feet thick, whilst the Hutton was only 4 feet. Bords, were driven about 5 yards wide, and pillars left 30 by 40 yards thick, so that 7-8ths of the coal was left in pillars for the time being. The pillars were removed in one portion of the upper seam, and a goaf of considerable extent was formed, but when the men came to work away the lower seam under this goaf, they found the coal very much harder, and more expensive to work than the other portions, and the result was that a larger proportion of whole coal was obtained from this portion of the seam. It would not stand to be undercut, but burst off with a crackling sound, the coal having been completely changed in character by the pressure from above. The point to be considered, therefore, was whether the advantage gained by the larger proportion of the whole coal which was obtained would compensate for the extra expense of working. In this case it might, but at the Usworth Colliery, the opposite effect seemed to take place; the removal of the pillars in the upper seam exercised a decidedly pernicious influence on the coal below. It had been, therefore, concluded that it was generally advisable when very heavy pressure was experienced to work away the upper seams first. The subject of working on the pillar and stall system, so as to obtain as much as possible of the seam, and so as to secure the safety of the miners, had engrossed attention for years, and they all ought to read and study the admirable evidence given before the Parliamentary Committees on the subjects of working and the prevention of accidents, particularly those in reference to pillar working, given in 1835 by Mr. Buddle, Mr. Nicholas Wood, Mr. George Elliott, and other eminent coal viewers. They would there find the proportion of loss dwelt on at considerable length, and it was stated that 50 per cent. was the amount of loss in the last century; and when the amount of good coal got was raised to 6 per cent. it was thought that considerable success had been achieved, whereas now-a-days it was held that three-fourths at least ought to be got, and, indeed, much more than that was frequently obtained. After all, however, much depended on the depth and strength of the seam as to the proportion of the pillars likely to be recovered. The first person who brought the working by pillars into favour was a Mr. Thomas Barnes, who in 1795 published some plans by which a larger proportion of the pillars could be obtained. This was done by taking off slices, until at last it became unsafe to do more, and the roof came down. In modern collieries enormous masses of coal were left in the first instance as pillars, which, being afterwards attacked in a way resembling the long wall system, by the judicious application of props and pack-walling, nearly the whole was obtained in good condition. Several eminent men had advocated modifications of the pillar system, with a view to the greater safety of the miners and the prevention of explosions, and many valuable suggestions had been made, but, except in beginning a new colliery, there were insuperable difficulties to anything like a thorough alteration of the system. They were, first, the impossibility in most cases of adapting in a partly worked-

out mine the plan on which it was commenced to a different plan, and the obstinate adherence of the working miners to the modes and systems they were accustomed to.

GEOLOGICAL SOCIETY OF LONDON.

At the annual general meeting, on Feb. 21 (WARINGTON W. SMYTH, President, in the chair), the SECRETARY read the reports of the Council, of the Library and Museum Committee, and of the Auditors. The continued increase in the numbers of the society, and its general prosperity, were stated to be very satisfactory.

The PRESIDENT announced the Award of the Wollaston Gold Medal to Dr. Carl Friedrich Naumann, Foreign Member of the Geological Society, Professor of Geology and Mineralogy in the University of Leipsic, &c., in recognition of his labours, extending over nearly half a century, in the departments of Geology, Mineralogy, and Crystallography; and especially for the admirable series of Geological Surveys of Saxony and adjoining countries, executed by himself and his coadjutors, between 1836 and 1843; and for the great standard work on Geology (Lehrbuch der Geognosie), which, with the excellent courses of lectures delivered by him at Freiburg and at Leipsic, has exercised a powerful influence on the education of the newer generation of continental geologists. In handing the medal to Prof. Ansted for transmission to the distinguished medallist, the President bore witness to the great value of Prof. Naumann's various works, and remarked that, in awarding to Prof. Naumann the highest honour which the society can bestow, the Council showed themselves truly desirous of seeking out merit wherever it exists, and that they thus testified their sense of the high value of labours carried on without show or blazon, but with a conscientious regard to the interest of scientific truth. Prof. ANSTED read a reply from Prof. Naumann, thanking the Council for the distinction which they had conferred upon him, and stating that it would lend him in his old age courage and strength to follow up to their completion the tasks which still lie before him.

The PRESIDENT then stated that the balance of the proceeds of the Wollaston Donation Fund had been awarded to Mons. J. Bosquet, of Maestricht, in aid of the valuable researches on the Tertiary and Cretaceous Mollusca, Entomostraca, and other fossils of Holland and Belgium, on which he has been so long and successfully engaged; and he placed it, together with a diploma to that effect, in the hands of Mr. Godwin-Austen, who undertook to forward it to that eminent palæontologist.

The PRESIDENT then proceeded to read his anniversary address, in which he reviewed some of the most important contributions to field geology and mineralogy made during the past year, including especially notices of the progress of the several geological surveys. The address was prefaced by biographical notices of lately deceased Fellows, including Mr. W. J. Hamilton, Dr. C. G. B. Daubeny, the Earl of Rosse, Mr. Evan Hopkins, Mr. Ashhurst Majendie, Sir Charles Lemon, Dr. James Black, &c.

The ballot for the council and officers was taken, and the following were duly elected for the ensuing year:—*President:* Professor T. H. Huxley, LL.D., F.R.S.—*Vice-Presidents:* Sir R. I. Murchison, Bart., K.C.B., F.R.S.; Prof. A. C. Ramsay, F.R.S.; Earl of Selkirk, F.R.S.; Rev. T. Wiltshire, M.A.; F.L.S.—*Secretaries:* P. M. Duncan, M.B.; John Evans, F.R.S.—*Foreign Secretary:* Prof. D. T. Ansted, M.A., F.R.S.—*Treasurer:* J. Gwyn Jeffreys, F.R.S.—*Council:* Prof. D. T. Ansted, M.A., F.R.S.; Duke of Argyll, D.C.L., F.R.S.; W. Boyd Dawkins, M.A., F.R.S.; P. Martin Duncan, M.B.; Sir P. de M. G. Egerton, Bart., M.P., F.R.S.; Robert Etheridge, F.R.S.E.; John Evans, F.R.S., F.S.A.; David Forbes, F.R.S.; Prof. T. H. Huxley, LL.D., F.R.S.; Sir Henry James, R.E., F.R.S.; J. Gwyn Jeffreys, F.R.S.; Prof. T. Rupert Jones; Sir Charles Lyell, Bart., D.C.L., F.R.S.; Prof. John Morris; Sir R. I. Murchison, Bart., K.C.B., F.R.S.; Robert W. Mylne, F.R.S.; Prof. A. C. Ramsay, LL.D., F.R.S.; Earl of Selkirk, F.R.S.; Warington W. Smyth, M.A., F.R.S.; Alfred Tylor, F.L.S.; Rev. Thomas Wiltshire, M.A., F.R.A.S.; Searles V. Wood, jun.; Henry Woodward, F.Z.S.

MANCHESTER GEOLOGICAL SOCIETY.—At the ordinary meeting of this society, on Tuesday, Mr. GREENWOOD in the chair, a specimen of a stone hammer, found in the clay on the slope of the land above Mossbrook, opposite Queen's Park, Harpurhey, was exhibited by Mr. DEVIS. It was stated to have occurred in a nest of sand, 2 ft. below the surface, in the undisturbed clay.—Mr. BINNEY said he thought it very difficult to tell whether the clays in such cases were undisturbed, as he knew that in a few years' time clay that had been filled in a hole or cutting generally settled down like the undisturbed clay, and he could hardly tell the difference. The stone hammer might have been buried at a remote period.—It was announced by the SECRETARY that a special circular would be addressed to the members for the next meeting, asking that any local stone weapons known to be in private collections might be brought for comparison, and the subject discussed as a general one on the stone implements used by early men.—Mr. R. A. ESKRIGGE read a paper of geological notes made in Leicestershire, describing the features seen in the district called Charnwood Forest. He said the rocks were probably of the same age as the Lawrentians of Canada, and equivalent in strata to the Malvern Hills, consisting of syenites, altered slates, and greenstones. No fossils had been found in any of the Charnwood rocks.—Mr. PLANT said he differed from the author of the paper as to the age of the rocks. It was a surmise without any foundation, in fact, to call them Lawrentians, especially as no gneiss rocks existed over the whole area of Charnwood Forest, and impressions of sea-weeds had been found on some of the slates. The syenites were interbedded and stratified with the slates, and the only true igneous rocks he had seen were the traps and porphyries.—Mr. BINNEY asked for information about the formation of the Moira coal field, he having observed a true breccia over the coal measures, which he thought was Permian?—Mr. J. AITKEN read a short paper on the drift occurring on Holcombe Hill, near Bury, in which he enumerated the character of the pebbles which formed a layer of gravel over the top of the moor, about 1000 ft. high, and also pointed out peculiarities in the junction of the rough grit with another rock.—A discussion followed as to the reality of a flint pebble found in the gravel on the high moor, and the opinion of several gentlemen was that it was a specimen of limestone chert, and not a flint from a chalk.—After the exhibition of a self-acting hook, to prevent overwinding from coal-shafts, the meeting.

SOCIETY OF ENGINEERS.—On Monday evening the paper read on the Surveys of the proposed lines for a Ship Canal between the Atlantic and Pacific, on the Panama Railroad, and on the Darien Ship Canal, by Dr. Cullen, will be discussed.

TREATISE ON THE STEAM-ENGINE.

The publication of a new edition of a work so extensively known and appreciated as "Bourne's Treatise on the Steam-Engine"* cannot fail to be gratifying to a large number, especially of the rising generation, connected with the engineering profession; and as Mr. Bourne's work has the very great merit of avoiding the propagation of views which might lead to the acceptance of dangerous fallacies, it may safely be consulted by all who are really desirous of acquiring valuable knowledge upon the subject of which it treats. During the 22 years which have elapsed from the issue of the first edition, the improvements introduced in the construction of the steam-engine have been both numerous and important, and for this reason Mr. Bourne has taken care to point out the more prominent improvements, and to furnish the reader with such information as shall enable him readily to judge of the relative value of each. The eighth edition has been thoroughly modernised, and made to accord with the opinions and practice of the more successful engineers of the present day, yet he has been careful to retain a sufficient record of former practice to prevent the deterioration of the work as a reliable historical treatise on the steam-engine. All that the book professes to give is given with ability and evident care: those scientific principles of the steam-engine which are tolerably permanent are admirably explained, and reference is made to many of the more valuable of the recently introduced engines.

With regard to the probable motive-power of the future, Mr. Bourne observes, in introducing the eighth edition of his work, that before the publication of the first edition he had arrived at the conviction that the steam-engine would pass away before very many years, and evidences of the soundness of these anticipations are presenting themselves every day. The most convenient substitute for the steam-engine would be a thermo-electro engine. But very little of a practical character has been yet done in this direction. At present public expectation points more in the direction of air and gas-engines as substitutes for steam, and both of these classes of engines have been to some extent practically introduced, and their use is extending. In the case of the steam-engine there is this momentous fact to stimulate improvement—that even in the best and most economical engines not more than one-tenth of the efficacy of the fuel is utilised as power. In the case of electro dynamic engines there is little loss, or, in other words, a given quantity of electricity produces very nearly its equivalent of mechanical power; but in the case of steam engines, a given quantity of heat does not generate more than one-tenth of its equivalent power, the rest being lost from the imperfections of the machine, so that we stand in much the same position as the hydraulic engineer would occupy if his water-wheel or turbine were so imperfect as to waste nine-tenths of the theoretical power of the water, and it is quite impossible, that this enormous fault in steam engines, now that it is so plainly perceived, can be very much longer tolerated. He considers that if we had any good way of transforming heat into electricity we should be able to work an engine with little more than one-tenth of the fuel now required; and it is needless to say what a revolution in most of the arts such a discovery would produce.

As to improvements in the steam-engine, Mr. Bourne does not consider that any tangible improvement has been made in it within his recollection, and that substantially it is the same machine as it was when dismissed from the hand of Watt. Wrought-iron and steel are now more largely used, and a higher pressure of steam is generally employed; but the principles of action, and main features of construction, remain precisely the same as they were before, and it does not appear probable that any considerable improvement can now be introduced into the steam-engine, except by some expedient which will enable higher temperatures to be employed with impunity. Superheating was one step in this direction, but it has been abundantly proved that where superheating is carried further than was usual in the old marine-flue boilers the lubrication of the piston and stuffing-boxes cannot be accomplished, and the valve-faces and other internal parts of the engine are so much damaged by internal corrosion, that the resulting injury outweighs the resulting benefit. Expansion is a resource always open to us whenever we choose to accept it, but in the judgment of engineers it may easily be overdone.

To express an opinion upon the value of such a work as "Bourne's Steam-Engine," which has passed through seven editions already, would be superfluous; but it may safely be stated that the work is worthy the attentive study of all either engaged in the manufacture of steam-engines or interested in economising the use of steam.

* "Treatise on the Steam-Engine in its various Applications to Mines, Mills, Steam Navigation, &c., with Practical Instructions for the Manufacture and Management of every species of Engine in Actual Use." By JOHN BOURNE, with 38 plates, and 546 woodcuts. London: Longmans, Green, and Co.

SCIENTIFIC PROGRESS ON THE CONTINENT.

It frequently happens that much valuable time is lost through the labourers in a particular branch of science or of industry traversing ground which has already been explored by others; and this is in most cases attributable to the circumstance that it is extremely difficult for any but those immediately connected with the scientific world to ascertain what has been published in the scientific periodicals of foreign countries. To remedy this inconvenience, a most useful publication has been issued since June last by Her MAJESTY'S Commissioners of Patents in the shape of an "Index to Foreign Scientific Periodicals contained in the Free Public Library of the Patent Office."* The extent to which the work may be made available can scarcely be judged of except by those who consult it for practical business purposes; but its general utility can be best tested by an example. Suppose an inventor is engaged in procuring a patent for the production of atmospheric gas, he will be able to find from the Index that in DINGLER'S "Polytechnisches Journal" for February, 1866, there appears an article extracted from the "Weekly Journal" of the Lower Austrian Industry Society on "Illuminating by Means of Atmospheric Air impregnated with the vapour of Petroleum," and that it is written by G. MARCUS. Now, even assuming that the reader's knowledge of German will not enable him to read the article himself, it will certainly be worth his while to obtain a translation, and thus, perhaps, for an outlay of a few shillings avoid the waste of many pounds. As every article in all the leading French and German scientific and industrial periodicals and Transactions of learned societies is thus given, the Index can scarcely fail to secure a very extensive circulation as soon as its existence becomes known.

The contents and general arrangement of the Index gives satisfactory evidence of much care and judgment having been bestowed upon it, and as it embraces not only a list of the articles in the order in which they appear in the several works, but also an index of authors from which the whole of their contributions can be seen at a glance, and an index of subjects from which all that has been done during the six months included in each volume in connection with the particular branch of industry in which the reader may be interested, it is difficult to conceive what further information could be desired. Thus, with respect to coal, attention is directed to articles on the consumption, machine-cutting, origin, exhaustion, and characteristics of coal, and on the effect of weather upon it, on the washing and sorting of it, &c., whilst with regard to coal pits it will be found that in the "Revue Universelle des Mines" there is an article (the date and page being given) by Mr. E. J. THONARD, "On wood linings for wagon ways in Coal Mines, and on the Use of Iron as supports for the roofs of workings," and likewise that during the period referred to in the volume there were published notices of coal pits in Japan, Pennsylvania, &c., &c., so that no one need long remain in ignorance as to the novelty or otherwise of any given announcement. The whole of the references to the products of coal, to cobalt, copper, motion, motive power, or to whatever else one may be interested in, can be found with equal facility, so that no one is likely to regret the 6s. 6d. per annum paid for their subscription.

Nor will the Index form an uninteresting volume to the general reader, for the mere reading of the titles will prove both amusing and instructive from the evidence they give of the varied fields of research which may be entered in the effort to benefit ourselves in particular and the world in general. The rapid passage from the record of the systematic and refined labours of the professors of the most sublime of exact sciences, to the memoirs of those who turn their attention to objects of interest in our everyday business, is really marvellous; thus, from the same page of the Index we learn that whilst LE VERRIER and DELAUNAY were discussing the discovery of another new planet, the thoughts of Messrs. REISET, BLANCHARD, and CHEVREUL were occupied by a paper "On the Damage done to Vegetation by Cockchafers and their Larvæ, and on the Means of Destroying this Insect." Instances of this kind of transition are innumerable, and should alone secure the Index patronage, more especially as it forms a handsome volume at the end of the year, and one of permanent and increasing interest.

* London: Office of the Commissioners of Patents, Southampton-buildings.

"INDEX TO THE TIMES NEWSPAPER."—Under this title Mr. S. Palmer, of Catherine-street, Strand, has published the first volume of a quarterly of vast importance to the members of the learned professions, the commercial world, politicians of every grade, and the reading community at large A glance at its pages directs immediate attention to every event which the "leviathan of the press" has considered worthy of notice in its columns during the preceding three months, thus reference to the multitudinous articles of the *Times* is wonderfully facilitated, and this universally diffused journal, no longer an ephemeral record of current events, becomes, with its "Index" at hand, a permanent common-place chronicle of inestimable value. Of the immensity of labour involved in this undertaking some idea may be formed from the fact of it containing not fewer than 30,000 references to articles which have appeared in the pages of the *Times* during the three previous months. The "Index" is very appropriately dedicated to the proprietors and editors of the *Times*, and has received from that journal a flattering token of appreciation in the form of a most eulogistic notice of its merits. Our readers will accept the following illustration of the simple, but ingenious, method adopted by Mr. Palmer to crowd into a volume of 165 pages the enormous number of headings we have cited. Under the head of "Mining Intelligence" we have, for example, 8*o*, 5*c*; 18*n*, 7*b*; 31*d*, 5*d*—signifying 8th Oct., 5th page, 3d column; 18th Nov., 7th page, 2d column; 31st Dec., 5th page, 4th column; the columns being distinguished, as is apparent from the letters of the alphabet, in regular rotation from a, being substituted for figures, thus avoiding perplexity. For the "Index to the *Times* Newspaper" we can safely prognosticate a glorious future, as it cannot fail to become an integral portion of every public and private library of any consideration, and the indispensable hand-book of every clerical, legal, commercial, and literary gentleman wherever the English language is read, or the influence of the *Times*, or—as the "Index" is almost equally applicable to such—any other English daily paper is felt and acknowledged.

COAL IN NATAL.—The comparative tests of Natal and English coal, made by Messrs. CROWDER and GAVIN, fully confirm the experiments previously made by Mr. EVANS, and it is considered that, compared with the English coal used on board the tug, the English coal was the best for gas purposes, and the Natal coal for the generation of steam. The latter coal has been found to give about 69 per cent. of coke and 6 per cent. of ash. A numerously-signed memorial has been presented to the Lieut.-Governor (Mr. R. W. KEATE), in which it is stated that the existence of coal seams at Biggarsberg and Newcastle has long been a matter of public notoriety, and that from these seams coals of excellent quality have been obtained. The memorialists are of opinion that the time has arrived for utilising the known coals, and for aiding the discovery of new carboniferous deposits; they, therefore, submit that suitable appliances should at once be put in operation for the examination of the different localities by experienced persons and the investigation of the whole subject. They regret that though the existence of coal in Natal has been patent for many years, so very little has been done towards ascertaining its real value and extent; and they indulge the hope that during His Excellency's administration of the Government the development and commercial utilisation of its coal deposits may be one of its most successful achievements. In conclusion, they feel assured that he will be pleased to give immediate effect to the prayer of the memorial. In replying to the memorial, the Lieut.-Governor remarks that at this moment a quantity of coal is on its way from Newcastle, and the Biggarsberg, to be tested at Durban as to its qualities for steam purposes, and the Surveyor-General's surveying operations will commence in the districts from whence it is brought, as being the localities where coal has hitherto been found in the largest quantities and the thickest seams, and been most brought into use for domestic and other ordinary purposes. In the meantime the Lieut.-Governor has requested to be favoured with the opinion of the well-known Director-General of the Geological Survey of Great Britain as to whether data collected and sent home by Dr. SUTHERLAND will suffice for the determination of the large considerations involved in the enquiry—whether, that is, Natal possesses an available coal field of sufficient extent to obviate hereafter the necessity and expense of supplying from England the coal used on these seas, not only by the mail steamers and large passenger vessels, but by the ships of the Royal Navy.

COAL IN AUSTRALIA.—The directors of the Australian Agricultural Company, in their report for the meeting, on Tuesday, say—"We are unable to report any improvement in the out-turn of the colliery, the estimated nett profit for the first ten months of the past year being but little in excess of 6000*l*. There has been no competition of price, for during the period all the companies have had a trade agreement for a uniform rate, and on Jan. 1, 1868, that uniform rate was raised to 10s. per ton. The demand for New South Wales coal in eastern ports has largely increased during the last 12 months, but owing to the high price of corn in this country, and the slackness of the general export trade, freight has been unattainable in the colonial ports, and large orders have remained unexecuted. When the export trade revives, this check upon shipments from Newcastle (New South Wales) will be removed, and there can be no doubt that a very large quantity of Australian coal will be exported. A few years ago it was held in little estimation as steam fuel, but that prejudice has now disappeared, it being generally admitted that the difference in favour of the best English coal is not more than 10 per cent. Our attention is continually directed to this important branch of the company's operations, and we hope that in future it will be rewarded with more success."

FOREIGN MINES.

JAVALI MINE.—The directors have received intelligence of the safe arrival at San Juan del Sur, in Nicaragua, of the machinery sent from San Francisco for the Javali. Mr. Julius Alington, one of the members of the board, who has gone out at his own expense to visit the mine, had come from San Francisco in the same steamer as the machinery (the voyage occupying 13 days), and writes from San Juan del Sur, under date of Jan. 27, as follows:—

"I am here with the machinery, quite safe and well. A Mr. Smith was on board last night; he has made all arrangements for the taking of the machinery to the mine. It almost seemed to take away his breath when he talked of our mine. Without my asking him anything about it he said, 'You have a grand thing in the Javali.' I believe him. Mr. Smith says he has made a contract 50 per cent. cheaper than the usual charge for taking our things to the mine."

ANGLO-ARGENTINE.—The directors have made arrangements with Mr. Barnard, formerly connected with the works, to proceed to Hilario and take a legal transfer of the property, &c. Mr. Barnard has selected the required stores, which will be shipped without delay. Mr. Barnard left by the steamer from Bordeaux on Tuesday.

CAPULA.—Capt. Paull, Jan. 8: We have taken out all the pitwork and the heaviest pieces of the engine; I hope to finish taking out the remainder in about a fortnight. We had to go to a great depth to get a good foundation for the loading of the cylinder; the masons are busily engaged, we have plenty of materials, and I trust to get the engine at work in March. The beneficio of the torta at San Cayetano hacienda is going on slowly, the azoguiro not being accustomed to the class of ore is carrying on what he cousiders a sure, but slow, beneficio; I expect it will be washed in about 16 days time, we shall then have another ready to send in; we shall also send some high ley metal to smelt with the 20 cargas taken down from San Pascual. We have been waiting to see whether the manceras succeeded or not in doing away with the partrido system at Arevalo Mine before putting the barretoros to break metal, but as yet nothing has been settled, and we have put the men to work to get sufficient for another torta. It grieves me to think we are compelled to let the barreteros take away the eighth part of the metal, but it cannot be avoided at present. The road has cost up to this date $2425 25c.; it is now in very good order, and we shall not have to lay out any more, at all events not this season. My estimate to Mr. Chynoweth for putting up a 30-ft. water-wheel and four barrels was $5000, but owing to the very large arch we shall have to turn over the river I think it will cost more. We have had the timber for the water-wheel for a long time, and the ironwork—that is, the heavy pieces—we can get from the Real del Monte Company; the small work we shall do at the mine. The ground is levelled for the launders, or leet, to take the water from the adit, and we are ready for the masons to commence building the wheel-pit, calcining-furnaces, &c., and as soon as we have finished the engine and boiler-house we shall put all hands about it, and if we had money we could go about it at once. I was in hopes that we should have been able to put up the hacienda from the produce of the metal, which we should have done had we had a place to send the metal to, where we could have got anything like justice done us. As soon as we get the engine to work we shall be able to extract sufficient ore to pay all the costs of the mine, and I trust enable us to finish the hacienda, besides sending metal to San Cayetano. I am in hopes we shall be able to send some to Sanchez hacienda to beneficiate in barrels; I hear they have not half the quantity they can reduce when in full work. There is no alteration in the mine since my last. We have got a very good English blacksmith, who, I think, will be able to make the borers stand against the hard ground, which of late has been a very great drawback, for want of a good smith.

ALAMILLOS.—Feb. 17: The lode in the 3d level, east of La Magdalena shaft, having come in contact with the slide, is very much disturbed; it produces ¾ ton of lead ore per fm. The 4th level, east of La Magdalena shaft, yields 1 ton per fm.; no change has taken place in the character of this lode since last report; the ground is hard for driving. The 4th level, west of La Magdalena, produces 1½ ton per fm. The ground in the 3d level, east of San Enrique shaft, is hard, and the lode is small and poor. An improvement has taken place in the 4th level, east of Taylor's engine-shaft, in the nature of the lode, the granite is much softer. The lode in the 5th level, east of Taylor's engine-shaft, is composed of carbonate of lime and lead ore, yielding of the latter 1 ton per fm. The 5th level, west of Taylor's engine-shaft, has opened into a large vugh. A decided improvement has taken place in the 4th level, west of San Andriano shaft, the lode producing 1 ton per fm. The lode in the 3d level, west of San Yago shaft, is poor at present, but well defined, and letting out plenty of water. In the 3d level, east of Crosby's engine-shaft, the lode has a better appearance, yielding stones of ore, with an increase of water. The lode in the 2d level, west of Crosby's cross-cut, produces 1 ton of ore per fm. This has fallen off in value within the last few days.—Shafts and Winzes: Taylor's engine-shaft, sinking below the 4th level, yields 1 ton of ore per fm. This has reached the required depth for a 5th level, and the men are put to drive east and west, as reported above. Berdu's winze, below the 3d level, produces 1½ ton of ore per fm.; this is down to the depth of the 4th level, and we expect to hole in a few days. Fernando's winze produces 1 ton of ore per fm.

LINARES.—Feb. 15: West of Engine-Shaft—South Lode: The 110, west of engine-shaft, produces ½ ton of lead ore per fathom; the lode is regular, containing a branch of ore in the bottom of the end, but the upper part is poor. The lode in the 75, west of Warne's shaft, is very large, consisting chiefly of quartz, carbonate of lime, and lead ore; of the latter it produces 1¼ ton per fathom. In the 75, east of Crosby's shaft, the lode is small, yielding, however, 1 ton of ore per fathom. The 31, east of San Francisco shaft, is now passing through a disordered piece of ground; the lode is small, producing ½ ton of ore per fathom.—East of Engine-Shaft: The lode in the 95, east of Taylor's cross-cut, is large and strong, and produces 1½ ton of ore per fathom. The 95, east of Taylor's shaft, yields ½ ton per fathom; the lode is very wide, and easy for driving. The 95, east of No. 154 winze, produces 1½ ton of ore per fathom; this end is opening a good piece of tribute ground.—Shafts and Winzes: Good progress is being made in sinking Warne's engine-shaft below the 75; the lode is very open, consisting of quartz and carbonate of lime, and yielding 2 tons of ore per fathom. No. 155 winze, below the 61, is being sunk in a very productive lode, which yields 2 tons of ore per fathom. The lode in No. 156 winze is small and poor.—Quiniento's Mine: At the time of the last report the lode in the western end, and for half the length of Taylor's engine-shaft, sinking below the 20, was worth at the rate of 3 tons per fathom; it was then cut off by a cross-course, the eastern part remaining disarranged and unproductive. This cross vein has now influenced the western end, also leaving the lode at present valueless. The shaftmen are making good progress in sinking, and the shaft will probably by the end of May be down to a 35 fm. level, when ends will be started east and west from the bottom of the same, and there is no doubt that a good lode will very soon be met with in each direction.

GONNESA.—R. W. Richards, Feb. 5: San Giovanni Mine: Caroline's engine-shaft was deepened during the past month 4½ metres; by the end of April it will be deep enough for a 60 metre level under Taylor's level. The 30 metre levels, east and west from Caroline's shaft, were extended 6 and 6½ metres, respectively, through ground that produced but little ore, the lode being large and promising. Taylor's level was extended west during the month 7 metres, through good ground, the average yield of which we estimate at 3 tons per fm. The same level, east of Caroline's, was extended 9 metres, through very promising, but almost unproductive, ground. Victor Emanuel levels, east and west from shaft, were driven 7 and 6½ metres, respectively, through ground that produced but little ore. The San Angelo cross-cut is still being extended in ferruginous limestone; we cannot fail to intersect the No. 2 lode there in the course of a few days. The stopes and tribute pitches throughout the mine are looking very well. We have not, however, raised that amount of ore on which we calculated, owing to an unusual influx of surface water, which penetrated through the upper ground, and filled some of the winzes and underhand stopes. During the past few days we have made some important discoveries of excellent quality calamine on the south of the slope of the mountain. When we have better examined them we will report more fully on their extent and apparent worth.—San Giovanedda Mine, Lead Section: The Nicolay level, on the No. 2 lode, was driven west in January 9 metres, through ground that yields on an average 2½ tons of ore per fathom. The stopes and tribute pitches in this mine are quite equal in production at this time to any former period.—Calamine Section: In January we made a road from both Nos. 1 and 2 deposits, to join the main road to Gonnesa. The men occupied in making this road are now employed in excavating Calamine Monte Cane Mine. Several metres of level and cross-cut have been made in this mine during the past month by the tributers, and some small pipes of ore discovered. The pitches yield the average amount of ore, with the same number of men. The very excessive and continuous rain that has almost stopped our out-door work during the month has been felt here more than in the other mines. The Calamine excavations being on the top of the hills, and, consequently, unsheltered, we could scarcely keep men to work; besides, our roads being new, we have great difficulties in the carriage.—Guttura Pala Mine: Here also, as mentioned in my last communication to you, we have made some discoveries of calamine, consisting of four lenticular masses of ore ground, varying in length from 12 to 25 metres, and in thickness from 2 to 3½ metres; three of these masses are on the back of the Garrucia lode, the other is on the Guttura lode. Probably there are other masses similar to those discovered in this mine. The difficulty of penetrating through the thick underwood with which the sett is almost entirely covered renders the examination of the surface of the lodes no easy task. In conclusion, I beg to say that the regretable circumstances that have tended to prevent the transport of our ore, as well as the regular working of the mine during the past month, may now be considered as no longer existing.

FORTUNA.—Feb. 15: Canada Incosa Mine: In the 100 fm. level, west of O'Shea's shaft, no alteration has taken place since our last report. The lode in the 90, west of Judd's shaft, yields 1½ ton of lead ore per fathom; the lode is large, and composed of sulphate of lime and lead ore. The lode in the 80, west of Judd's shaft, contains small quantities of lead ore. The 70, east of Carro's shaft, is getting out of the influence of the cross-course, and the lode, which produces 1½ ton of ore per fathom, is improving. The 55, east of Carro's shaft, is holed to the 55, west of Santo Tomas shaft.—South Lode: The 50, east of San Pedro shaft, produces ½ ton of ore per fathom; the lode is large, and has a very good appearance. In the 50, west of San Pedro shaft, the lode is at present small and valueless. The 40, west of San Pedro shaft, yields ½ ton of ore per fathom. In Gomez' winze, below the 30, the ground is easy, and the lode, which produces ½ ton of ore per fathom, is of a very promising character.—Los Salidos Mine: Having had to change a piece of the main-rod, very little has been done in the 100, west of Morris's engine-shaft, since last report. The lode in the 90, west of Morris's engine-shaft, is small and poor. In the 65, west of San Carlos shaft, the lode yields ½ ton of ore per fathom. The 100 east, like the 100 west, has been hindered on account of the water. The 90, east of Cox's shaft, produces 2½ tons of ore per fathom. The 75, east of San Pablo's shaft, yields 3 tons per fathom. The 65, east of San Miguel shaft, has passed through some small strings of lead ore.—Shafts and Winzes: San Pablo's shaft, below the 65, is completed to the 75, and the men are driving east of same; the lode yields 2½ tons per fathom. Buenos Amigos shaft, below the 75, produces 1½ ton per fathom. Good progress is being made here. Carrascosa's winze, below the 75, is going down in a very productive piece of ground; the lode yields 2½ tons per fathom.

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending February 23 amounted to 9908*l*. 8s. 9d.

SILICEOUS STALACTITES IN LODES, VEINS, AND BASALTIC CAVITIES.

Fig. 1.

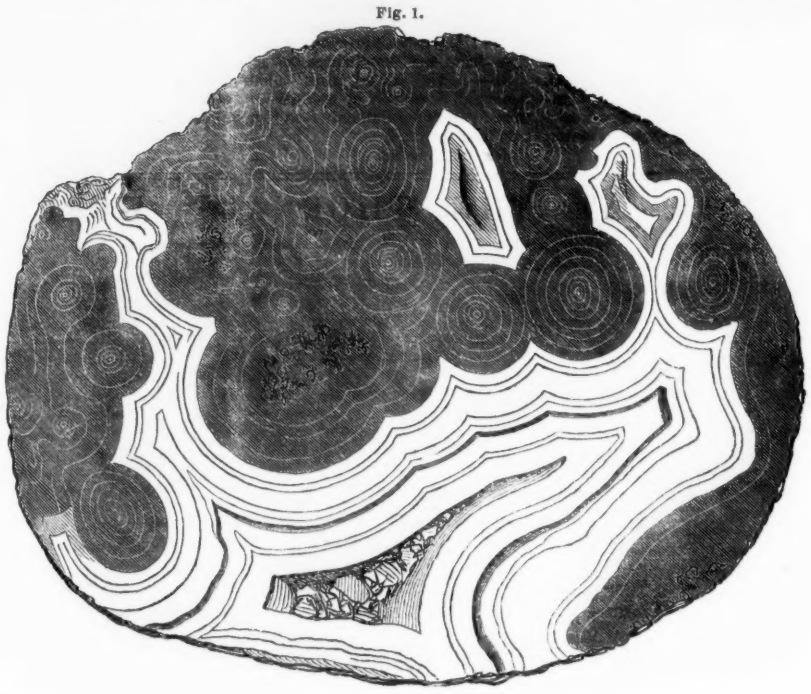


Fig. 2.

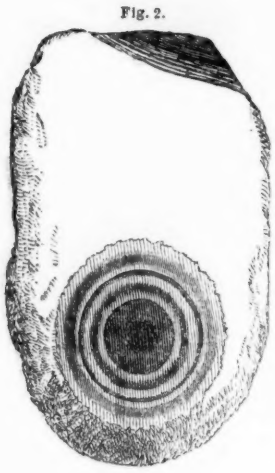


Fig. 3.

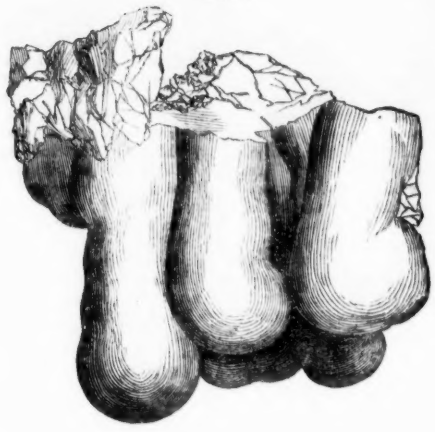


Fig. 4.

Fig. 6.

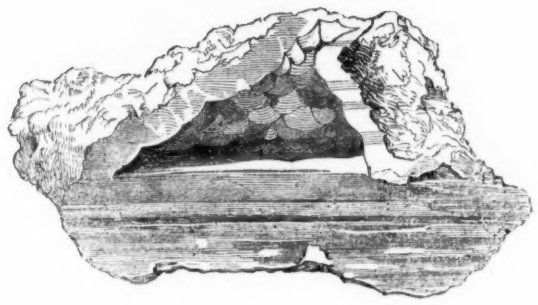
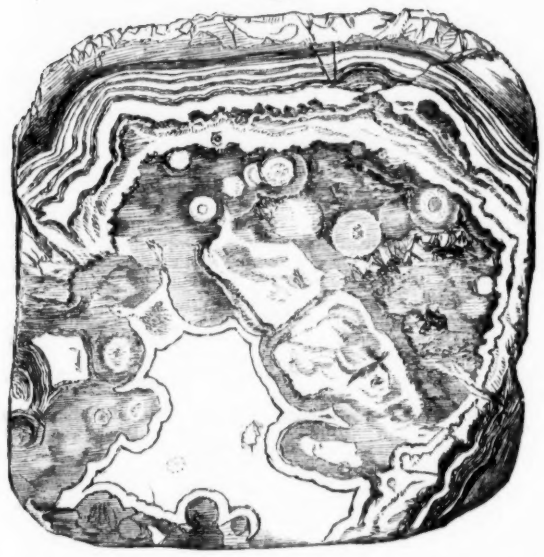


Fig. 5.



ON SILICEOUS STALACTITES IN LODES, VEINS, AND BASALTIC CAVITIES.

SIR,—A period of nearly 30 years has elapsed since, under the heading of "Filtering Chalcedonies and Agates," I ventured to promulgate my opinions upon the subject. During this interval numerous opportunities have presented themselves to me to continue my researches, my professional engagements in mining and discovering lodes having led me to visit almost every part of the globe. In my absence, others with the command of wealth for the collection of specimens for illustration, and an enviable amount of leisure from the cares and anxieties of daily toil, have laboured in the same field. With many of these it has been but little else than an agreeable relaxation from the desk and office. They may have rushed, with hammer and pencil in hand, to a deep railway cutting, and marked the varied contortions and irruptions of former periods, gathered at a slight expenditure of labour a few pleasing mementos of their enthusiasm, and with the additional aid of the contents of a cabinet, stocked at some considerable pecuniary sacrifice, have gratified their taste, and have accumulated many interesting and useful facts. How widely different, however, is the lot of those who, like myself, have been impelled to gather the earliest scintillations of Nature's glorious operations on the scenes of her majesty and power, and where the surrounding objects are those of wildness and inaccessibility. Such, in general, from the nature of my professional engagements in the determining of mineral wealth, and exploring new ground in various parts of both the eastern and western hemispheres, has been my position, exposed to every vicissitude of climate, eagerly pursuing the object in view under the direct scorching rays of the sun, in a torrid zone, or exposed to the lowest grade endurable by humanity, my physical energies almost paralysed by an amount of toil that few would care to endure, suffering from severe accidents, the result of a too venturous spirit, of hunger to be ultimately appeased by devouring the most unsavory food, and thirst which I should have rejoiced to quench at the most polluted reservoir —I have been adding, at the same moment, to my stock of facts and specimens. For one single mineral I toiled along a dreary, hazardous, and trackless waste for a distance of 800 miles. In the pursuit of another, I and my ship were delayed at great mental and pecuniary cost a whole month; whilst for a third I had to pay 600*l*. Under hardships and privations of the most aggravated character I still persevered. At all risks of life and limb, and totally regardless of social and personal comfort, I felt determined to add to my store. I at length became insatiate; the fever was upon me; the more I had the more I wished to possess; I was enraptured with the beautiful exactitude of chemical equivalents, and mathematical niceties of mechanical force, these enabling me to trace the apparent mysteries through a series of elaborate network to the simplest ordination of cause and effect. But whist thus wandering sometimes through untrodden regions, and frequently far removed from the influence of post and paper, I found others had been labouring in the field. Of these, one had laid down with a crushing argument, supported by reference to the examples at his command, a questionable hypothesis. Another, more feeble in reasoning powers, or less confident in his strength, had approached the subject, but finding the task too subtle for his endurance, had left it after a very slight and unsatisfactory passage of arms; whilst a third had brought to the assault the needful auxiliaries of a powerful judgment, combined with exquisite refinement of taste and analogical reasoning.

The subject before us is one fraught with such an amount of apparent contradictions, that it would be impossible, within such space as I feel justified in claiming at your hands, to reconcile differences and remove doubts where these occur. Nor would it be practicable to refer to the various theories already promulgated, relative to the temperature and condition under which veins have been formed. Relative to these points, I know that opinions differ as wide as the poles. I shall, therefore, not attempt to lay down my views dogmatically, or as the only theory worthy of acceptance, but will simply suggest the opinions which a lengthened and hardly-earned experience, aided by constant reference to a series of specimens at my command, enable me to do.

For the original run of the siliceous breccia we must trace the mountain steppes, and mark where the transition rocks hold their place between those of an older and others of a more recent date. We thus examine the great basalt or trap intrusions that have penetrated the earth's crust, sometimes in long dykes, like those which have split the granite of the Kalmorden ranges in Sweden, the Erzbrighdt in Bohemia, and other places of interest to those who have had the good fortune to explore them; sometimes in great shoulders, like the ghauts in India; and, again, in conical outcrops, similar to the Buddah in New Guinea, where, running back into the strata that have been traversed at various intervals it may be compared to the reclining branches of a larch tree. The great and natural basalts would seem to have been subjected to a process not dissimilar to that of iron in running from the furnace, judging, at least, from the appearances presented at a favourable point of view. Imagination here depicts the huge molten mass expanded into a pasty condition, traversing from a gigantic cauldron through granite and other rocks, regardless of all lithological character, and occasionally meeting with fissures and cavities in the more consolidated rock, gradually filling up the vacant spaces, and still journeying on at various altitudes; running itself into every convenient vacuity, it constitutes the connecting link between the dolorites of the granite and the lavas of the more recent volcanoes; then, forming itself into one uniform and unbroken mass of its own kind, and occasionally by a sudden local or partial declension or upheaving of the granite through which its course is pursued, it becomes an integral portion of that peculiar geological phenomenon generally termed dykes or faults. A critical examination of structure tends further to confirm the analogy between the molten iron and the natural basalt. The cellular structures in the runs from the former assume an amygdaloid appearance, owing to the greater pressure in that direction, the cells ranging themselves laterally with the sides of the moulds. The rocks through which the basalt passes form walls, and exert a similar contracting pressure upon the latter, the results in both cases being analogous. The gas bubbles in the iron in a minor degree correspond with those of Nature's grander work in the production of larger cavities. At a temperature requisite to render solid matter fluid, the cohesiveness of the atoms is destroyed, and with that the original form of the matter exposed to the calorific influence. In the absence of foreign fluids, either liquid or æriform, a vapour with a chemical constitution identical with the molten mass may be engendered, and these causes, acting either separately or in conjunction, produce changes of the most important nature upon the subsequently formed mass, as, for instance, in the case of lead in a state of fusion. If in this condition it be poured on the surface of a mass of iron in a like condition, though the lead when cold possesses a specific gravity equal to about one and a half times greater than the iron, it will float upon the surface of the iron. This phenomenon arises entirely from the influence of the bubbles of vapour of the lead, and which by their levity reduce to the degree referred to the specific gravity of the entire mass.

The cellular construction arising from confined atoms of vapour is necessarily influenced by the character of the gaseous body secreted in the mass when at its highest temperature at the time of its molten state. These vapours, or gases, under the high temperature force the mass into its cellular condition, at the same time being enclosed in the mass they are like so many bubbles, and occupy a respective space at that temperature which in the subsequent cooler state cease to require the space in which they originally ranged themselves. This is a point of the highest importance, as here we have a great mechanical force set up, more violent than is usual in the slow operations of nature, and hence the beautiful results. The general mass of rock having cooled, and become rigid, the walls of the cells retain, to a great extent, their original form, and the force set up by the exhaustion causes a secretion from the surrounding mass into the cells, resulting in a corresponding equalisation and adjustment of the mass to a modified extent.

It is at this point of subdued temperature that the silica, lime, and silicates of lime, depending in their relative proportions on the composition of the rocks from which they have been extracted, filter into the cell, and, according to the temperature at the time of infiltration, either run down into layers (see Fig. 6), become rigid in stalaclitic, or botryoidal form (see Fig. 3), or crystallised (refer to specimens No. 16). The cavities may be divided into classes. Those in which silica is alone the composition of the cells, such as many of the basaltic ranges of South America and other places; those in which lime and silica occupy the cell, each inan in dependent condition—as, for instance, the Buddah ranges of New Guinea, Cambay, &c.; here it frequently happens that the silica coats the crystallised lime, leaving a perfect cast of the same, should the lime by chemical or other agency be afterwards removed; those in which exist silica and silicates of lime. The most magnificent and superb illustrations of these occur in the ghauts of India, where sometimes cells of 3 or 4 ft. long, lined with crystallised quartz, 6 or 7 in. in thickness, upon which are found scolecite, poonahlite, apophyllite occur in every varied form of crystallisation, and those in which the silicates of lime occur alone; as, for instance, the mesotypes, phillipsites, harmotomes, thomsonites, chabacite, &c.

It often happens that the crystals of quartz, lime, &c., are coated with a film of chalcedony, as in the extraordinary specimen, No. 28. This suggests to the mind an enquiry into the nature of the gas, which originally expanded the cell, inasmuch as we have seen that metals in a state of fusion yield a vapour of their own kind; then, their might exist a vapour of silica, which would account for the phenomenen in specimen 28, or a vapour of silicate of lime, which would account for the opaque white line exhibited in the centre of Fig. 1, and in the outer circles of Fig. 2.

Carbonic oxide, which would not be an impossible condition where hydrated compounds were present, as the decomposition of those bodies, containing the requisite constituents, would yield them up for combination with other matter under the force of superior attraction. Again, carbonic acid, in obedience to similar laws might also be found to exist.

From what I have advanced it is evident that the question will now arise as to the temperature at which these highly interesting and important changes were effected. It appears that a very considerable diminution of original temperature must have taken place to have allowed the reduction of volume to set up sufficient force to secrete the fluid, and I have already called attention to the fact that in many instances the silica has sunk to the bottom, and has there consolidated with a level surface. With, perhaps, a very slight alteration of temperature, the infiltered silica has been enabled to sustain its own reniform character, and has consolidated in that form. At a yet lower temperature, and perhaps in a very slight degree, we have the siliceous and other intruded fluids crystallising, and in other instances the crystals bursting up portions of the floors. I think it may safely be assumed that the three conditions here mentioned have taken place at a comparatively low temperature. We find in vughs and cavities, in veins and lodes, precisely the same class of specimens, stalactitic and crystallised, but rarely ever the floor-like structure. On comparing some of the calcedonic stalactites of the trap with similar ones from the veins, they are analogous, both in their reniform and botryoidal character; moreover, both series show occasional deviation from the true perpendicular line of the stalactite, although more prominently so in the lode specimens; both have conformed to the altered inclination or throw of the mass.

It appears, then, that veins and lodes may have been formed at a very low temperature, and this view is supported by the almost total absence of liquid runs of silica, as the temperature was sufficiently moderate to allow the retention of the filtered silica in its stalactitic or crystalline form. The reason of the marked alterations of the angles of lodes generally will form the subject of a future paper. To facilitate my design, and to render the subject more instructive to my readers, I have ventured to attach to this article a series of illustrations and descriptions of siliceous deposits. The woodcuts will add

much to the descriptions, and, I trust, invest the subject treated upon with an additional interest.

DESCRIPTION OF SPECIMENS FROM THE AMYGDALOIDAL GEODES OF THE TRAP SERIES.*

FIG. 1.—An agate, the face of which is 11 inches by 9, cut at right-angles to its stalactitic arrangement, and shows on its face its first cacholong lining of the cavity or cell, driven towards the centre by the subsequent secretion into the cell. The cacholong band is folded up, having arranged itself in the centre into a smaller compass than it previously occupied. Here the numerous stalactites that appear have evidently fallen through, and the siliceous paste present in the cell has absolutely yielded to the superior force of the stalactites, which, at the time of entering, could have been no more than siliceous paste.

FIG. 2 is a siliceous stalactite of very large dimensions, which must have filtered into a vugh, or cell, of corresponding magnitude. This has an outer crust of the white compact chalcedony, with a succession of lines following of the same character, but in the body of the stalactite the white lines disappear, illustrating that the part which came in contact with the gas present in the cell underwent an alteration, intensifying its opacity, which the part less exposed has not been influenced by. The side of the drop on this specimen has been polished, for the purpose of illustrating the very shallow depth at which this action has taken place.

FIG. 3.—A cluster of stalactitic chalcedonic drops, 9 in. by 5 in., which have consolidated in a cell free from that particular vapour, which has altered the external character of Fig. 2. This is, perhaps, the finest, largest, and most characteristic specimen of basaltic chalcedony in the world. It evinces a rather low temperature, as the termination almost approaches the temperature of crystallisation, the thickening may, perhaps, be compared to a candle dipped into a vat of tallow at too low a temperature.

FIG. 4.—A mammalated mass, or rather a conglomerate of stalactites, most beautifully illustrating numerous concentric lines, and a delicate blending of colours. This, like Fig. 3, has been formed at a very low temperature, and almost at the crystallising point, inasmuch as the centre is absolutely an aggregate mass of crystals. It would appear that at the turning point of temperature a struggle had ensued as to whether the whole mass should not have been crystallised.

FIG. 5.—The face of this siliceous mass exhibits an exquisite display of colours, from the most brilliant amethystine tint to the blue chalcedonic veins, which show a succession of very violent faults, and perhaps, owing in part to this faulty arrangement, the mass is studded over with concretionary or pisolitic siliceous aggregations, many of which in polishing the face of this superb amethystine agate have been cut through their centre.

FIG. 6.—A chalcedony of excessive beauty, unique in form and colour. In it the silica appears to have accumulated at a temperature higher than in any of the preceding specimens, inasmuch as the bulk of the substance has run down and arranged itself in a succession of floor-like tables or layers on the bottom of the cavity, and it is not until the temperature had arrived at a lower point that the subsequently secreted chalcedony had been enabled to retain the botryodal structure which followed the irregularities of the coat of the cell. Owing to the sea-green lines of the layers so harmoniously blending into the rich and delicate brown of the upper chalcedony, giving delight to and relieving the eye, this may be justly regarded as a gem. Its equal might be vainly sought in the cabinet of any collector.

SPECIMENS NOT FIGURED.

7.—Chert stalactite, slightly diverging as if from a common centre, with silicate of lime. It shows the structure of the stalactite by a succession of coatings, the outer coating corresponding with the mammalated surface of the inner stalactite, in parts spotted over with brilliant cornelian red spots.

8.—Chalcedonic stalactites, enclosing fragments of the matrix rock, coated with chert, appearing like small globes. Interstices filled up with deep-coloured amethystine crystals.

9.—A variety of the same.

10.—Large slab of agate, with its stalactites cut through, showing delicate hollow centres, looking like moss or threads, some tangled, or even knotted. Some of the stalactites have pressed down the white lines of the agate to its centre and bent them round the outlines of the various stalatitic drops.

11.—A large polished slab, cut across the stalactite, with portions of the earthy matter of the rock dragged through into the siliceous paste, giving it a moss-like appearance. The numerous concentric white lines, very much contorted and squeezed up by the stalactite, but no true fault. The mass is minutely studded with pisolitic or uniform spots of red, almost microscopic, giving a deep cornelian colour to the whole. The further beauties of this specimen it would be difficult to describe.

12.—A large polished mass, with a vermilion red centre, and patches of light green and moss-like interruptions.

13.—Blue-yellow and deep red chalcedony, intermixed with angular fragments of rock, exhibiting much violence of action.

14.—Polished mass, showing brilliant amethystine centre. Next crystallised white quartz, and last, and outside bands of red and white chalcedony, with faults and heaves.

15.—A very fine polished agate, 4½ by 3½ in. Scarlet, with purple chalcedony; the centres of the stalactites show several lines of formation, the brilliancy and contrast of colour has a wonderful effect, and for beauty is most probably unparalleled.

16.—A polished agate, encircled by a jasper-red band, with a crystallised centre, shows evidence of external pressure and consequent contraction.

17.—An agate, the silica of which is delicately filled with red pisolite concretions, with several breaks in the white belt.

18.—Polished agate, with crystallised white centre, then a broad band of most lovely pink, then a white band, then dark, and then dark red, and a second and third ditto, which last is broken off, and blended in the general chalcedonic mass. The red, if not the pink, band owes its colour to minute reniform specks of a red colour. *This is a real beauty.* [handsome.

19.—A rich brown polished agate, with a yellow centre, and is very

20.—An agate, with a brilliant vermilion centre, surrounded by chalcedony. The extreme outside belt is sprinkled with dark pisolite concretions.

21.—A polished agate, 8½ by 5½ in. White lines most quaintly flawed and broken on the one side, whilst the other side seems to have been left undisturbed. A magnificent and beautiful specimen.

22.—A red agate, with a light-coloured centre. A radiating cluster of crystals has pressed into the chalcedonic paste, and in some instances blended the points of the crystals with the chalcedony. Very instructive and interesting.

23.—The polished extremity of a large stalactite, 6½ inches across, which has 41 concentric lines of white interchanging with the darker ground, a bright ash-grey, with various tints of intensity. Here the eye will never weary of examining, but will long linger with delight.

24.—A deep rich-coloured sard geode, of the very brightest oriental colour, with a yellow internal band.

25.—A large polished brecciated mass of what some careless mineralogists would designate red jasper. The opaque white is broken and squeezed into corners, and minutely dotted with red pisolitic spots, whilst the rich cornelian red of the mass does not apparenlty show that phenomenon.

26.—A polished mass of yellow stalactite, embedded in light-coloured chalcedony, and of extraordinary reniform structure, as though the stalactite had burst, and much brecciated.

27.—A polished yellow breccia, much disturbed by mechanical violence showing faults, part of the stalactites in bands, part reniform, and part in arborescent-like character.

28.—Portions of a geode, about 1 foot in length, with large amsthystine crystals, pointing towards a centre, and beautifully coated over with blue chalcedony. This looks as if the siliceous gas present in the cell had consolidated upon the silica, that had afterwards secreted and filtered into the geode.

29.—A crystalised mass of quartz, the crystals borrowing the form of calcite. Supposing the cell which this silica had filtered into and crystallised to have been filled with a lime vapour, then it would appear possible that such vapour might have exercised certain modifying influences upon the form of the crystals. This speculation, although put forward with caution, is worthy of the gravest consideration.

SPECIMENS FOUND IN CAVITIES OF LODES AND VEINS.

30.—A cluster of chalcedonic stalactites, from a cavity in a Cornish lode, very similar to Fig. 3, which was from a basaltic cavity.

31.—A group of chalcedonic stalactites from a cavity in a Cornish lode. The stalactites in their normal condition drop perpendicular, the lode having subsequently altered its inclination, before the stalactites became rigid. In this specimen they have curled down, and indicate, to a certain extent, the angle of alteration corresponding with the throw of the country generally.

32.—An exquisite mass of chalcedonic stalactites and plates, with green centres, and here and there reniform balls of dolomite attached. On minutely examining this specimen, the chalcedony exhibits the appearance of thousands of globules run together. The specimen forms one of a small selection made from the Trowbridge collection, which has lately changed hands several times.

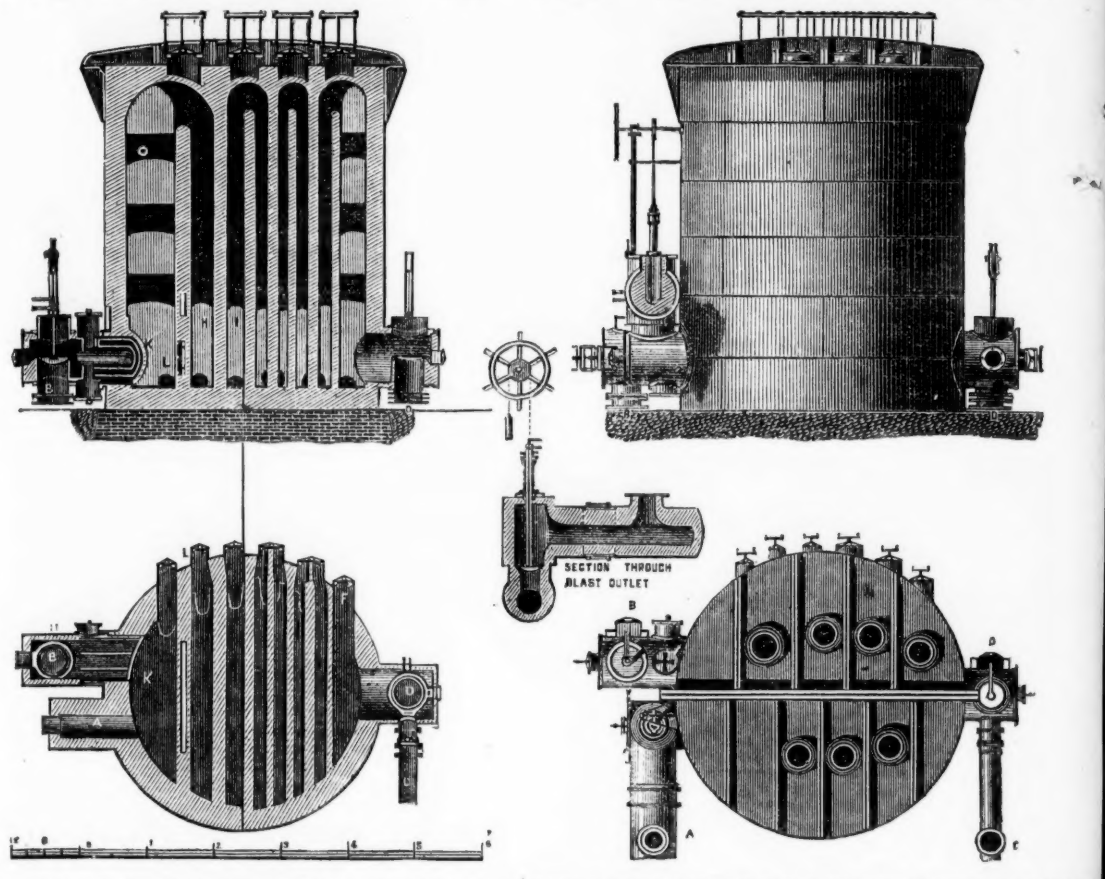
33.—Specimens of brecciated opal, from a vein, the cavities filled with stalactites and reniform masses of the same substance. This is also from the Trowbridge collection.

34.—A yellow and pink coloured opaline mass filled with most beautiful drenditic, or tree-like, ramifications. A vein traverses the mass, which is dislocated and broken, showing fracture and corresponding faults.

JOHN CALVERT, C.E.,
Strand, London. Mining Engineer.

* These specimens are selected from a large series, all of which may be regarded as unique.

HOT-BLAST STOVE AT THE THORNABY WORKS.



The annexed engraving illustrates a novel form of hot-blast stove, which has been used for some time at the Thornaby Ironworks, Stockton-on-Tees. In the Cleveland district, where economy in working is studied as much, or perhaps more, than in most other iron producing districts, it has been found that with an increase of every 100° in the temperature of the blast above 750° a saving of about 1 cwt. of coke on the ton of iron made has been effected. Hence, in order to produce pig-iron as economically as possible, it has become necessary to provide a very large and expensive plant of heating stoves. Mr. Whitwell's hot-blast stove contains no cast-iron pipes, but is constructed of fire-brick, ganister, or other refractory material—enclosed in cast-iron—which is capable of enduring the greatest heat that can be obtained from the combustion of the blast-furnace gas, and hence all wear and tear of cast-iron stove pipes is saved, whilst a temperature of blast is obtained which would be probably unattainable under any circumstances in any stove constructed with cast-iron pipes. In working this apparatus two similar stoves are used, which by preference are of a circular form, and whilst the blast is being heated in the one the other is being heated by the blast-furnace gas, which is introduced at the gas inlet B; the air necessary to effect combustion being introduced through the Argand burner K, also at the air inlet L; in this instance the air is heated to a high temperature before meeting the gas, and thus induces a most intense combustion.

The gases ascend and descend the walls of the stove, passing under the central longitudinal wall in their course to the chimney, as at H and I; the products of combustion, after imparting their heat to the brickwork, pass off to the chimney at D. When a sufficient temperature has been obtained the process is reversed, the blast is introduced into the stove just heated, and issues therefrom at a temperature nearly equal to that already communicated to the brickwork by the burning gas, passing, in fact, over the self-same surfaces over which the gas has already travelled. The cold-blast is introduced at C at that end of the stove whence the products of combustion have previously been passing at a low temperature to the chimney, by which means the blast is gradually heated, so that when it reaches that part of the stove which is red-hot it has attained to nearly the same temperature, and issues from the stove as above mentioned at a red heat. A distinguishing feature of these stoves, however, is that they may be cleaned from the dust deposited on the heating surfaces by the gas, without being cooled down, and without it being necessary to enter them: for this purpose doors or valves, E, protected by brickwork are placed at the top and at the sides of the stoves, and by opening those at the top the dust can be scraped from the heating surfaces and removed by the bottom valves, F, without any loss of time. Hence it is not necessary to purify the gas before using it. The valves are so arranged as to allow sufficient air to be admitted to burn the gas perfectly, by which means the gas is consumed with great economy; for, whereas in cast-iron pipe stoves the gas issues from the chimney at a heat of nearly 2000°, in these stoves the products of combustion pass into the chimney at a temperature of from 500° to 700°, the difference being absorbed by the heating surfaces, and returned to the blast-furnace in the heated blast. The construction of this stove will be readily understood from our engravings. The principle on which the apparatus acts is not new, but the details and general arrangements are novel, and constitute features of much excellence. The *Engineer* from which paper we obtain our information, states that a pair of these stoves are now working at the Thornaby Ironworks, Stockton-on-Tees. They are cleaned every two months, and this is accomplished in four hours and a-half, whilst red-hot, by means of wire brushes and rakes. The ordinary stoves require 36 hours to cool, clean, and get up heats again, thus producing irregularity in the working of the furnaces. The patentee has arranged with Messrs. Siemens and Cowper for the use of their patents in this hot-blast stove.—*Mechanics' Magazine.*

SHAREHOLDER'S LIABILITY AS CONTRIBUTORY.—Shipman's case in *re* the Joint Stock Discount Company (Limited), was where shares in this company had been purchased by one person in the name of another, who was an irresponsible person. The transfer was executed and left at the office for registration on the 2d of February. In the ordinary course of business the transfer should have been examined by a director within a week or ten days, and his report should have been confirmed at the next weekly meeting. The transfer was not examined until the 27th of February, and on that day the director noted on it that enquiry should be made as to the responsibility of the transferee. No enquiry was made, nor was the transfer considered at the next meeting; and it remained unregistered until the 3d of March, when it was resolved that no transfers then in the office should be registered. The Master of the Rolls held that, as the responsibility of the transferee was a condition of registration, no waiver of the right of the company to refuse to register could be inferred from the delay which had taken place in dealing with the transfer; and that the name of the registered owner (Mr. Shipman) must, therefore, remain on the list of contributories.

PURCHASE OF SHARES—TRANSFER AND REGISTRATION.—The case of Robins *v.* Edwards was heard by the Lord Chancellor, on appeal from the Master of the Rolls. The plaintiffs were stockbrokers, whom the defendant had frequently employed to purchase shares for him, and in August 1864, acting under his instructions, they bought 100 shares in Smith, Knight, and Co. (Limited), and sent the defendant a contract for the purchase. The purchase was not completed by the defendant on the settling-day, but at his request the transaction was continued. Calls were made on the shares, which the plaintiffs were compelled to pay, and the repayment of which they demanded from the defendant without effect. The Master of the Rolls made a decree by which he ordered the defendant to pay the amount claimed by the plaintiffs, and, so far as was possible, to procure the shares to be registered in his name. The Lord Chancellor affirmed the decree; observing that if the transfer could not be made the plaintiffs were, at all events, entitled to the amount of the calls which they had paid and to an indemnity against future liabilities.

SURETIES.—It is provided by the 5th section of the Mercantile Law Amendment Act, 1856, that "every person, who being surety for the debt or duty of another, or liable with another for any debt or duty, shall pay such debt or perform such duty," shall be entitled to stand in the place of the creditor, and to use all the remedies at law or in equity against the principal debtor, in order to the indemnification for the advances made by him. In the case of De Wolf *v.* Linsdell, it has been decided by the Master of the Rolls that a surety on a bond made before the passing of the Act, who paid on the bond after its passing, was entitled to the benefit of that section.

LIABILITY AS CONTRIBUTORY.—A shareholder who institutes proceedings against a company to repudiate his shares, and is prosecuting mthe when a winding-up order is made, is entitled to be struck off the register if he makes out his case of misrepresentation. But where, as in the case of Mr. Stevenson *re* the Cleveland Iron Company, the shareholder instituted no proceedings of his own against the company, but pleaded misreprcsentation to an action for calls, and obtained a verdict (a rule was subsequently made absolute to set the verdict aside), and shortly after the verdict a winding-up order was made, it was held by the Master of the Rolls (whose decision was affirmed on appeal) that this did not amount to such action on his part as brought the case within the above rule, and that the shareholder was, therefore, liable as a contributory.

INTEREST UPON CALLS.—Stocken's case, in *re* the Blakeley Ordnance Company (Limited), was heard by Lord Justice Lord Cairns, on appeal from a decision of the Master of the Rolls; the question being whether, after a forfeiture of shares in this company, interest upon the calls due at the date of the forfeiture could be demanded of the shareholder whose shares had been forfeited. The articles of the company rendered the shareholders liable to pay interest at 25 per cent. on calls in arrear. It was also provided that the forfeiture of any share should involve the extinction at the time of the forfeiture of all interest in, and all claims and demands against the company in respect of the share, and all other rights incident to the share; but that any member whose shares should have been forfeited should, notwithstanding, be liable to pay to the company all calls owing at the time of such forfeiture. The Lord Justice held (affirming the decision of the Master of the Rolls) that after a forfeiture of shares no interest was, under the articles, payable upon calls due at the date of the forfeiture. It was also held that there was no right of interest by virtue of the statute 3 and 4 Will. IV., c. 42, s. 28.

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